

No. Publication No.

Title

1. 2000 - 175926 ULTRASONIC THERAPY INSTRUMENT

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# PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2000-175926

(43)Date of publication of application : 27.06.2000

(51)Int.Cl.

A61B 17/22

A61B 18/00

(21)Application number : 10-355099

(71)Applicant : TOSHIBA CORP

(22)Date of filing : 14.12.1998

(72)Inventor : SAKO YOICHI

TAKADA YOICHI

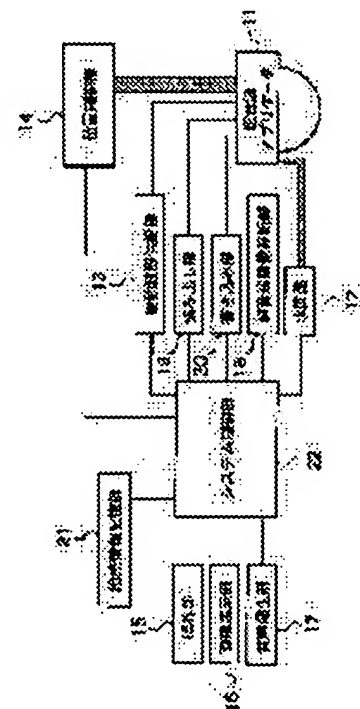
ISHIBASHI YOSHIHARU

## (54) ULTRASONIC THERAPY INSTRUMENT

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide an ultrasonic therapy instrument surely and automatically changing various kinds of setting in an ultrasonic therapy instrument using plural ultrasonic applicators by exchanging.

**SOLUTION:** This instrument is formed of a storing part of individual information concerning each ultrasonic applicator 11, a means for reading each individual information from the storing part and a means for writing each individual information in the storing part. At the time of exchanging the applicator 11, various kinds of setting is automatically changed to minimize time for operation. Since manual operation for complicated setting changing operation is eliminated, erroneous setting can be prevented and desired normal treatment is safely executed.



## LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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JAPANESE

[JP,2000-175926,A]

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CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION  
TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

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[Translation done.]

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## CLAIMS

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### [Claim(s)]

[Claim 1] In the ultrasonic therapy equipment which irradiates a supersonic wave to the predetermined part for a therapy, and acquires a curative effect The ultrasonic generation source which generates said supersonic wave, and the driving means which performs the drive of this ultrasonic generation source, the control means which performs motion control of this driving means, a storage means to hold the individual information for performing said motion control of said ultrasonic generation source, and the read-out means for reading said individual information from said storage means -- since -- the ultrasonic therapy equipment characterized by being constituted.

[Claim 2] Ultrasonic therapy equipment according to claim 1 characterized by having a write-in means for writing said individual information in said storage means.

[Claim 3] Ultrasonic therapy equipment according to claim 1 or 2 characterized by said storage means to have the ultrasonic applicator which has the structure which can be freely detached and attached from the body of said ultrasonic therapy equipment, and irradiates a supersonic wave to said part for a therapy, and to hold said individual information, and said ultrasonic generation source having the configuration included in said ultrasonic applicator.

[Claim 4] Ultrasonic therapy equipment according to claim 3 characterized by having said storage means by which replaced with said individual information and the identification code corresponding to this individual information was held.

[Claim 5] Ultrasonic therapy equipment given in either of claims 1-4 characterized by having said ultrasonic generation source which has an image diagnostic-ultrasound probe and said individual information containing setups required for actuation of this image diagnostic-ultrasound probe.

[Claim 6] Ultrasonic therapy equipment given in either of claims 1-5 characterized by having the propagation medium control means which controls at least one of the amount of said propagation medium in an enclosure means by which the ultrasonic propagation medium of said ultrasonic generation source is enclosed with the interior, impregnation, discharge, or temperature.

[Claim 7] Said individual information The drive frequency, impedance characteristic, or/and phase characteristic of said ultrasonic generation source, The predetermined reinforcement of the supersonic wave which irradiates an object part and time amount, the thermal denaturation area size of the object part in ultrasonic irradiation, A class or/and the purpose of use, the field that can be treated, magnitude, or/and a configuration, the inside of the amount of use hysteresis and said propagation medium, impregnation, discharge, or temperature -- at least one, setups required for a drive, and \*\* -- ultrasonic therapy equipment given in either of claims 1-6 characterized by expressing at least one or more inside.

[Claim 8] Ultrasonic therapy equipment given in either of claims 1-7 characterized by expressing the control condition for preventing generating of the electrical potential difference and current on which said individual information differed from the predetermined value.

[Claim 9] Ultrasonic therapy equipment given in either of claims 1-8 characterized by having a received wave analysis means to analyze the reflected wave which said ultrasonic generation source sent the supersonic wave with the predetermined output, and this ultrasonic generation source received after predetermined time, and a self-test means by which the analysis result output from said received wave analysis means performs the self-test of said ultrasonic generation source.

[Claim 10] an adjustment means by which said ultrasonic generation source performs load adjustment with at least one or more ultrasonic generating components, and said ultrasonic generating component and said driving means -- since -- ultrasonic therapy equipment given in either of claims 1-9 characterized by being constituted.

[Claim 11] The ultrasonic-therapy equipment characterized by to have the control means which the drive wave pattern beforehand remembered to be the drive wave impressed to said ultrasonic generation source by said driving means by

this body of ultrasonic-therapy equipment in the ultrasonic-therapy equipment which irradiates the supersonic wave emitted from the ultrasonic generation source driven by the driving means to the predetermined part for a therapy, and acquires a curative effect compares [ control means ], and stops the output of this drive wave in agreement or un-agreeing.

[Claim 12] The ultrasonic-therapy equipment characterized by to have the control means which the drive wave impressed to said ultrasonic generation source by said driving means compares [ control means ] with the prediction drive wave which were computed based on the electrical characteristics of this ultrasonic generation source in the ultrasonic-therapy equipment which irradiates the supersonic wave emitted from the ultrasonic generation source driven by the driving means to the predetermined part for a therapy, and acquires a curative effect, and stops the output of this drive wave in agreement or un-agreeing.

[Claim 13] Ultrasonic-therapy equipment characterized by to have an impression band control means by the configuration in which the drive wave outputted by said driving means is impressed to said ultrasonic generation source via the band-pass filter which passes only a predetermined frequency band in the ultrasonic therapy equipment which irradiates the supersonic wave emitted from the ultrasonic generation source driven by the driving means to the predetermined part for a therapy, and acquires a curative effect.

[Claim 14] Any one or ultrasonic therapy equipment of any one publication in claims 5-13 of the claims 1-3 characterized by the supersonic wave irradiated from said ultrasonic generation source converging on a predetermined location with a focusing means.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the ultrasonic therapy equipment which irradiates a supersonic wave and treats the part for a therapy.

[0002]

[Description of the Prior Art] There are a lithotripter which irradiates a powerful supersonic wave (impulse wave) from the outside of the body, and crushes a calculus to ultrasonic therapy equipment, an ultrasonic warm temperature therapeutic device (hyperthermia equipment) which only a cancer cell is annihilated using the difference in the heat sensitivity of neoplasm tissue and normal tissue, and treats a neoplasm, an ultrasonic cautery therapeutic device which treats by converging a supersonic wave on the part for a therapy, irradiating, and carrying out the heating necrosis of cancer, a neoplasm, etc. in the living body.

[0003] In case it treats using these equipments, according to the difference in the therapy approach, a therapy part, etc., it will be necessary to use two or more kinds of ultrasonic applicators properly.

[0004] Especially in the ultrasonic cautery therapeutic device, when treating the affected part inside an organ under the case where the direct affected part is treated from the outside of the body, or an incision in the abdomen, or when treating combining the laparoscope, an endoscope, etc., the therapy approach that plurality differs is examined. Two or more kinds of ultrasonic applicators furthermore set by the purpose according to the difference in the magnitude of a therapy object domain or a configuration are needed.

[0005] modification of the various set points which contain reinforcement, irradiation time, a frequency of a supersonic wave, etc. for every ultrasonic applicator when using two or more kinds of such ultrasonic applicators -- it is necessary to carry out -- moreover -- or it is generated also when you need modification of treatment planning which includes examination of the exposure approach of a supersonic wave according to each ultrasonic applicator.

[0006] moreover, the field which enables the therapy of the ultrasonic applicator concerned chosen to the equipment user -- or it is necessary to change the conditioning of the display means for telling the therapy condition by ultrasonic irradiation, and a voice generating means

[0007] In order to change these various setup accompanying modification of an ultrasonic applicator, it is necessary to carry out exchange of the circuit apparatus concerning the drive wave feed zone for generating the input of modification information, the change of the various switches accompanying it, and the wave that drives an ultrasonic sound source etc.

[0008] As a conventional technique, according to JP,7-289577,A, in case ultrasonic vibrators are exchanged, the configuration that the main frame sets up the frequency according to the resistance concerned corresponding to the detected resistance is indicated by detecting the resistance of the resistance with which the ultrasonic vibrator is equipped.

[0009] However, in such a conventional technique, it is because just the drive frequency of vibrator is not enough as the information which the body of ultrasonic therapy equipment needs in order to prepare two or more kinds of ultrasonic applicators to the body of one ultrasonic therapy equipment, to drive these ultrasonic applicators of a variety of appropriately when exchanging and using according to various therapy conditions, and to acquire sufficient curative effect.

[0010] In the former, in using ultrasonic therapy equipment, the reinforcement of a supersonic wave, irradiation time, the target field which can be treated, etc. are indispensable, and, naturally those conditions change with the classes and applications of an ultrasonic applicator.

[0011] For this reason, when exchanging a variety of ultrasonic applicators and applying to a therapy, corresponding to

each ultrasonic applicator, various setup by the side of the body of ultrasonic therapy equipment needed to be changed manually.

[0012]

[Problem(s) to be Solved by the Invention] However, modification of these conventional various setup was a very complicated activity covering two or more items. Moreover, if a setting change is made human, the error of a setup may occur, and when the error of such a setup occurs [ 10,000 ] also in 1, faults, such as actuation on the conditions on which it does not have the intention of equipment, may arise.

[0013] furthermore, the effect on the organization by the exposure of the ultrasonic output which deviated from the predetermined value which the right therapy which met treatment planning by the error of a setup was not performed, or the design meant -- and the condition which is not desirable for the subject may generate the effect on a blood vessel which is not meant.

[0014] Thus, exact and positive modification of various setup at the time of the effect by the error of a setup in ultrasonic therapy equipment exchanging the ultrasonic applicator with which it is large with an applicator and some kinds differ to the error of a setup in an ultrasonic diagnostic imaging equipment is very important.

[0015] In this invention, it is made to make a change of various setup of the body of ultrasonic therapy equipment accompanying exchange of two or more kinds of ultrasonic applicators according to the therapy purpose automatically, and the human error of compaction of the working hours required in order to set up, and a setup is prevented beforehand, and it aims at offering the ultrasonic therapy equipment which brings about the optimal curative effect by the minimum invasion.

[0016]

[Means for Solving the Problem] In the ultrasonic therapy equipment which according to this invention according to claim 1 irradiates a supersonic wave to the predetermined part for a therapy, and acquires a curative effect in order to attain the above-mentioned purpose The ultrasonic generation source which generates said supersonic wave, and the driving means which performs the drive of this ultrasonic generation source, the control means which performs motion control of this driving means, a storage means to hold the individual information for performing said motion control of said ultrasonic generation source, and the read-out means for reading said individual information from said storage means -- since -- let it be a solution means to be constituted with the ultrasonic therapy equipment by which it is characterized.

[0017] Moreover, according to this invention according to claim 2, let it be a solution means to have a write-in means for writing said individual information in said storage means with the ultrasonic therapy equipment according to claim 1 by which it is characterized.

[0018] Moreover, according to this invention according to claim 3, it has the ultrasonic applicator which has the structure which can be freely detached and attached from the body of said ultrasonic therapy equipment, and irradiates a supersonic wave to said part for a therapy, and said storage means to hold said individual information, and said ultrasonic generation source make it a solution means to have the configuration included in said ultrasonic applicator with the ultrasonic therapy equipment according to claim 1 or 2 by which it is characterized.

[0019] Moreover, according to this invention according to claim 4, let it be a solution means to have said storage means by which replaced with said individual information and the identification code corresponding to this individual information was held with the ultrasonic therapy equipment according to claim 3 by which it is characterized.

[0020] Moreover, according to this invention according to claim 5, let it be a solution means to have said ultrasonic generation source which has an image diagnostic-ultrasound probe and said individual information containing setups required for actuation of this image diagnostic-ultrasound probe with the ultrasonic therapy equipment of a publication at either of claims 1-4 by which it is characterized.

[0021] Moreover, according to this invention according to claim 6, the ultrasonic propagation medium of said ultrasonic generation source makes it a solution means to have the propagation medium control means which controls at least one of the amount of said propagation medium in the enclosure means enclosed with the interior, impregnation, discharge, or temperature with the ultrasonic therapy equipment of a publication at either of claims 1-5 by which it is characterized.

[0022] According to this invention according to claim 7, said individual information Moreover, said ultrasonic generation source, Predetermined reinforcement and time amount of a supersonic wave which irradiate drive frequency, an impedance characteristic or/and a phase characteristic, and an object part, The thermal denaturation area size, the class, or/and the purpose of using the object part in ultrasonic irradiation, Among the amount of the field which can be treated, magnitude or/and a configuration, use hysteresis, and said propagation medium, impregnation, discharge, or temperature, at least one setups required for a drive, and \*\* -- let it be a solution means to express at least one or more



inside with the ultrasonic therapy equipment of a publication at either of claims 1-6 by which it is characterized.

[0023] Moreover, according to this invention according to claim 8, said individual information makes it a solution means to express the control condition for preventing generating of the different electrical potential difference and different current from a predetermined value with the ultrasonic therapy equipment of a publication at either of claims 1-7 by which it is characterized.

[0024] Moreover, according to this invention according to claim 9, let it be a solution means to have a received wave analysis means to analyze the reflected wave which said ultrasonic generation source sent the supersonic wave with the predetermined output, and this ultrasonic generation source received after predetermined time, and a self-test means by which the analysis result output from said received wave analysis means performs the self-test of said ultrasonic generation source with the ultrasonic therapy equipment of a publication at either of claims 1-8 by which it is characterized.

[0025] moreover, an adjustment means by which said ultrasonic generation source performs load adjustment with at least one or more ultrasonic generating components, and said ultrasonic generating component and said driving means according to this invention according to claim 10 -- since -- let it be a solution means to be constituted with the ultrasonic therapy equipment of a publication at either of claims 1-9 by which it is characterized.

[0026] Moreover, according to this invention according to claim 11, it sets to the ultrasonic therapy equipment which irradiates the supersonic wave emitted from the ultrasonic generation source driven by the driving means to the predetermined part for a therapy, and acquires a curative effect. Compare the drive wave pattern beforehand remembered to be the drive wave impressed to said ultrasonic generation source by said driving means by this body of ultrasonic therapy equipment, and it sets un-agreeing [ agreement or ]. Let it be a solution means to have the control means which stops the output of this drive wave with the ultrasonic therapy equipment by which it is characterized.

[0027] Moreover, according to this invention according to claim 12, it sets to the ultrasonic therapy equipment which irradiates the supersonic wave emitted from the ultrasonic generation source driven by the driving means to the predetermined part for a therapy, and acquires a curative effect. Compare the drive wave impressed to said ultrasonic generation source by said driving means with the prediction drive wave computed based on the electrical characteristics of this ultrasonic generation source, and it sets un-agreeing [ agreement or ]. Let it be a solution means to have the control means which stops the output of this drive wave with the ultrasonic therapy equipment by which it is characterized.

[0028] Moreover, according to this invention according to claim 13, it sets to the ultrasonic therapy equipment which irradiates the supersonic wave emitted from the ultrasonic generation source driven by the driving means to the predetermined part for a therapy, and acquires a curative effect. The drive wave outputted by said driving means makes it a solution means to have an impression band control means by the configuration impressed to said ultrasonic generation source via the band-pass filter which passes only a predetermined frequency band with the ultrasonic therapy equipment by which it is characterized.

[0029] Moreover, according to this invention according to claim 14, let it be a solution means for the supersonic wave irradiated from said ultrasonic generation source to converge on a predetermined location with a focusing means with any one or the ultrasonic therapy equipment of any one publication in claims 5-13 of the claims 1-3 by which it is characterized.

[0030] If it does in this way, when using two or more ultrasonic applicators of the same class, based on individual information, there is [ easy and ] no mistake, a setup of drive conditions can be ensured, and discernment management of the information required for hysteresis management can be carried out.

[0031] Furthermore, based on the information according to each, the optimal propagation medium for each ultrasonic applicator is controllable.

[0032] furthermore -- setting up the drive conditions of a mistake, in case two or more ultrasonic applicators are exchanged \*\*\*\* -- or even if it should be alike and unexpected fault arises to an ultrasonic generation source, malfunction can be prevented under supervising an electrical potential difference and a current.

[0033] Furthermore, even if there is unexpected fault produced to the ultrasonic generation source, it can prevent that the supersonic wave which can perform suitable maintenance control since detection by the self-test can be performed beforehand, and is not meant is irradiated.

[0034]

[Embodiment of the Invention] Hereafter, the operation gestalt of this invention is explained based on a drawing.

[0035] Being shown in drawing 1 expresses typically the configuration of the ultrasonic therapy equipment concerning this invention.

[0036] The ultrasonic applicator 11 with which the ultrasonic therapy equipment concerning this invention irradiates a

supersonic wave, The water circuit 12 which makes the ultrasonic applicator 11 circulate through degassed water 35, and the drive wave feed zone 13 which supplies energy to an ultrasonic generation source, The position control section 14 for moving an ultrasonic vibrator 31, and the control unit 16 which performs input of a patient's data etc., and actuation of equipment, The image display section 16 and the voice generating section 17 which tell an equipment user about therapy information and a condition, The ultrasonic diagnostic imaging section 18 for obtaining the image information of a therapy field, and the read-out section 19 for taking out the individual information on the ultrasonic applicator 11 to the ultrasonic applicator 11, It consists of the write-in section 20 for recording information, such as use hysteresis of the ultrasonic applicator 11, the therapy information storage section 21 which memorizes various therapy information, and the system control section 22 which generalizes and controls the whole ultrasonic therapy equipment. [0037] Being shown in drawing 2 a expresses typically the configuration of the ultrasonic applicator 11 concerning this invention.

[0038] the coupling film 33 for the ultrasonic applicator 11 to spread the ultrasonic vibrator 31 which is an ultrasonic generation source, the ultrasonic probe 32 for ultrasonic image 3 \*\*, and the supersonic wave irradiated from the ultrasonic vibrator 31 to a body tissue, and the storage section 34 which memorizes the individual information on an ultrasonic applicator -- since -- it becomes. Moreover, it is filled with ultrasonic propagation media, such as degassed water 36, between an ultrasonic vibrator 31 and the coupling film 33.

[0039] Being shown in drawing 2 b expresses the outline of the component of the storage section 34 concerning this invention.

[0040] As shown in drawing, the individual information on the ultrasonic applicator 11 is memorized by the storage section 34.

[0041] The contents of such individual information The field information 45 which can be heated, the therapy depth and injection power, such as a class / purpose-of-use information 44 the fundamental-frequency information 41, the impedance-characteristic information 42 depending on the frequency of an ultrasonic vibrator 31 and the phase characteristic information 43, for [ for the outside of the body ] /into the trap, etc., and the focal depth of an ultrasonic vibrator 31 And the relation between irradiation time and the thermal denaturation area size of an affected part organization The ultrasonic applicator which made the main things the ultrasonic probe information 49, such as a class of the shown heat denaturation map information 46, the size information 47 on the ultrasonic applicator 11, the water circuit flow rate information 48, and image diagnostic-ultrasound probe, and a frequency, use hysteresis information 50, etc. It consists of required information for using it.

[0042] The ultrasonic vibrator 31 has fundamental frequency for every class, and when an ultrasonic vibrator 31 is driven in the fundamental frequency, it can transform electrical energy into ultrasonic energy most efficiently. Therefore, the fundamental-frequency information 41 at the time of driving an ultrasonic vibrator 31 turns into important information, and the drive wave feed zone 13 determines the drive frequency of the ultrasonic vibrator 31 concerned based on this information.

[0043] In case the frequency modulation driving method is used for the impedance-characteristic information 42 and a phase characteristic 43, they become important. When an ultrasonic vibrator 31 is driven on a frequency which is different in fundamental frequency 41, matching of the ultrasonic vibrator 31 including the matching circuit 53 at the time of originating in the impedance characteristic and phase characteristic of an ultrasonic vibrator 31, and seeing from an amplifier 52 side shifts from an optimum value. For this reason, the different electrical potential difference and different current from a predetermined design value depending on drive frequency may be supplied to a trembler 31, and electrical load which is different from a predetermined design value in amplifier 52, or the matching circuit 53 and an ultrasonic vibrator 31 may be impressed.

[0044] Then, in the ultrasonic therapy equipment concerning this invention, using the impedance-characteristic information 42 and the phase characteristic information 43, before a supersonic wave is irradiated, a different output from a predetermined design value controls the drive wave feed zone 13 using the suitable output set point which computed the suitable output value not becoming and was computed by beforehand [ the ].

[0045] By showing the class of ultrasonic applicator 11 which the equipment user chose, a class / purpose-of-use information 44 is used in order that an equipment user may check that the suitable applicator 11 corresponding to the therapy made into the purpose is chosen, and it is used for operation and un-working, a setup of the operation range, etc. [ of the position control section 14 ] For example, when the ultrasonic applicator 11 is an object for into the trap, the position control section 14 does not work but can consider the case where it is used when an equipment user holds the ultrasonic applicator 11 by hand.

[0046] The field information 45 which can be heated shows the focal depth of the selected ultrasonic applicator 11, and to the ultrasonic image used for the diagnosis before the therapy, by displaying in piles the field which can be treated, it

is used in order to tell an equipment user about the part which can be treated.

[0047] Moreover, the heat denaturation map information 46 is the information which showed the relation of the reinforcement of the supersonic wave at the time of treating using the selected ultrasonic applicator 11, and the thermal denaturation area size of irradiation time and an affected part organization, and in order to perform an effective therapy, it is important information.

[0048] When irradiation time is short, in order that the reinforcement of a supersonic wave is not smaller than a proper value, or thermal denaturation of the purpose part may not be carried out completely and a cancer cell etc. may not carry out a thermal denaturation necrosis, a curative effect is not fully acquired.

[0049] Moreover, when irradiation time is long, more than ultrasonic reinforcement is larger than a proper value, or the affected part carries out thermal denaturation, for example, the effect of [ to the organization of the purpose part ] which is not meant may arise.

[0050] For this reason, the heat denaturation map information 46 turns into important information for performing the most effective therapy for invasion at its minimum. The depth of a therapy part and the parameter of a location are also woven in, and this heat denaturation map information 46 makes detailed conditioning possible.

[0051] Moreover, the size information 47 on the ultrasonic applicator 11 is needed when controlling a successive range etc., in case the position control section moves the ultrasonic applicator 11, and the water circuit flow rate information 48 turns into important information, when controlling the water circuit 12.

[0052] In case the ultrasonic applicator 11 especially small [ for into the trap etc. ] is used, it originates in the absolute volume and there is an inclination for generation of heat from an ultrasonic vibrator 31 to become large in comparison. On the other hand, by performing suitable control of the water circuit 12 based on the water circuit flow rate information 48, generation of heat of the ultrasonic applicator 11 which is not meant can be prevented effectively. It can prevent that the predetermined ultrasonic output by furthermore the impedance characteristic and phase characteristic of an ultrasonic vibrator 31 changing with generation of heat which an ultrasonic vibrator 31 does not mean is no longer obtained.

[0053] Moreover, when the material which has elasticity in the coupling film 33 shown in drawing 2 a is used, telescopic motion of the coupling film 33 can be produced by carrying out impregnation of degassed water and control of a discharge. Since the thickness (depth of water of vertical degassed water 35) of the ultrasonic propagation medium enclosure section changes by this telescopic motion, the focal location of the supersonic wave irradiated according to the purpose of a therapy etc. can be adjusted free.

[0054] The ultrasonic probe information 49 sets up the various conditions of the ultrasonic diagnostic imaging section 18, and it is used in order to obtain the tomogram for ultrasonic diagnostic imaging. The use hysteresis information 50 turns into information required in order to be used for the purpose of engine-performance maintenance of telling an equipment user about the maintenance stage of an ultrasonic vibrator 31 and to ensure the stable therapy by recording the use hysteresis of the ultrasonic applicator 11.

[0055] As an implementation means of the storage section 34, use of semiconductor memory, such as RAM and ROM, magnetic storage, etc. can be considered, for example. The degassed water 35 supplied from the water circuit 12 between an ultrasonic vibrator 31 and the coupling film 33 is filled. The ultrasonic applicator 11 can be simply attached and removed on a body.

[0056] The outline configuration of the drive wave feed zone 13 which starts this invention at drawing 3 is shown.

[0057] The drive wave feed zone 13 concerning the gestalt of operation of this invention The wave generation section 51 which generates the drive wave for driving an ultrasonic vibrator 31, The amplifier 52 for amplifying the wave outputted from the wave generation section 51, the matching circuit 53 for supplying power to an ultrasonic vibrator 31 efficiently, and the output monitor 54 which checks the output state of amplifier 52 -- since -- it has the configuration which supplies a drive wave to an ultrasonic vibrator 31 with the directions from the system control section 22.

[0058] If put into the power source of ultrasonic therapy equipment by the equipment user, the system control section 22 will perform the connection confirm of the ultrasonic applicator 11. When a defect has the ultrasonic applicator 11 in un-connecting or connection, the system control section 22 gives an equipment user warning through the image display section 16 and the voice generating section 17.

[0059] When the ultrasonic applicator 11 is connected normally, the system control section 22 reads the individual information on the ultrasonic applicator 11 from the storage section 34 of the ultrasonic applicator 11 using the read-out section 19.

[0060] The system control section 22 tells an equipment user about therapy adaptation information, such as a class of ultrasonic applicator 11, and external use / use into the trap, through the image display section 16 or the voice generating-section 17 based on the read class / purpose-of-use information 44, and tells an equipment user about

therapy information corresponding to the therapy mode, such as a field which can be treated, through the image display section 16 further.

[0061] Thereby, an equipment user can check whether the suitable ultrasonic applicator 11 for the purpose of use is connected, and can perform a suitable therapy.

[0062] In this case, hysteresis, such as an old time of vibrator, is displayed on the image display section 16, and an equipment user is told about an exchange stage, an inspection stage, etc. which the design based on aging of the ultrasonic applicator 11 means. For this reason, an equipment user can always check the use hysteresis of the ultrasonic applicator 11, and the suitable maintenance of him is attained. Moreover, when it passes over an exchange stage, the insurance device of controlling impossible [ a therapy ] using the applicator can also be added.

[0063] Moreover, based on the therapy mode information 44 and the ultrasonic applicator size information 47, use / intact selection, movable range, etc. of the position control section 14 are set up, and an equipment user is told through the image display section 16.

[0064] Next, the system control section 22 controls the water circuit 12 based on the water circuit flow rate information 48 on the ultrasonic applicator 11, and sets up the ultrasonic diagnostic imaging section 18 based on the ultrasonic probe information 47. By controlling the suitable water circuit 12 corresponding to the ultrasonic applicator 11, generation of heat which the ultrasonic applicator 11 at the time of a therapy does not mean can be prevented.

[0065] Moreover, since change of the impedance characteristic of the ultrasonic vibrator 31 by generation of heat and a phase characteristic can be pressed down by controlling the above-mentioned water circuit 12, it can treat by irradiating suitable and the stable supersonic wave of an output.

[0066] In addition, when degassed water 35 is filled by the ultrasonic applicator 11, the ultrasonic probe 32 with which the ultrasonic applicator 11 concerned was equipped can be used now, and it becomes possible to perform the diagnostic imaging by the ultrasonic tomogram required in order to form treatment planning.

[0067] If control of the water circuit 12 is performed and it is [ using the ultrasonic tomogram by the ultrasonic probe 32 ] ready for diagnostic imaging, the system control section 22 will tell an equipment user about diagnostic imaging having become possible through the image display section 16 or the voice generating section 17. At this time, an equipment user performs the diagnostic imaging of the part for a therapy, and a control unit 15 is operated based on the image diagnostic information obtained by this. Various setup of ultrasonic therapy equipment based on treatment planning which starts the part for a therapy by this actuation is inputted.

[0068] Before starting an actual therapy here, the system control section 22 performs a prior self-test, in order to check the function of an ultrasonic vibrator 31. With self-test directions of the ultrasonic vibrator 31 of the system control section 22, the drive wave feed zone 13 impresses the wave of the very weak output of extent which does not affect a living body to an ultrasonic vibrator 31. Next, the reflective power of the reflected wave which changed vibrator 31 to the receive state and the vibrator 31 concerned received is measured with the output monitor 54.

[0069] The comparison with this measured reflective power and the reflective power which was computed from the impedance characteristic 42 and the phase characteristic 43 and which is expected is performed. When the difference of the actual measurement of reflective power and a calculation value compares whether it is in criteria within the limits, it can know whether the property of an ultrasonic vibrator 31 is normal. If the property of an ultrasonic vibrator 31 is normal, the system control section 22 will direct continuation of a therapy as it is.

[0070] If the property of vibrator 31 is unusual, the system control section 22 will tell an equipment user about the abnormalities of an ultrasonic vibrator 31 through the image display section 16 and the voice generating section 17, and will suspend a therapy immediately. Not only before initiation of a therapy but after degassed water is filled by the ultrasonic applicator 11, the self-test of an ultrasonic vibrator 31 can be performed in every phase, and may carry out multiple-times operation in each phase of a therapy.

[0071] If treatment planning is inputted, the system control section 22 will determine ultrasonic irradiation conditions, such as irradiation time of a supersonic wave, injection power, and the exposure approach, based on the heat denaturation map information 46. The heat denaturation map information 46 shows the relation between the irradiation time of a supersonic wave, injection power, and the thermal denaturation area size of the affected part, and changes with ultrasonic applicators 11 to be used.

[0072] moreover, the distance from the body surface of the part for a therapy -- or the optimal conditioning is minutely made by the location of the distance from the front face of the part for a therapy, and the part for a therapy. Based on the determined ultrasonic irradiation conditions, the system control section 22 gives directions to the drive wave feed zone 13 and the position control section 14, and a therapy is started.

[0073] The system control section 22 directs an output wave amplitude that the injection power which directed the drive frequency based on the fundamental-frequency information 41 in the wave generation section 51, and was

specified based on the impedance-characteristic information 42 and the phase characteristic information 43 by the above-mentioned treatment planning is obtained in the wave generation section 51. Furthermore, it sets up so that the matching circuit 53 may be in the optimal condition based on the fundamental-frequency information 41, the impedance-characteristic information 42, and the phase characteristic information 43.

[0074] The schematic diagram shows the relation between the output wave of the wave generation section 51 concerning the gestalt of operation of this invention, and the output wave of amplifier 52 to drawing 4 a and drawing 4 b.

[0075] In the drive conditions which use a frequency modulation method for an ultrasonic output especially, since it becomes impossible to take impedance matching of the matching circuit 53 and an ultrasonic vibrator 31 except fundamental frequency as shown in drawing 4 a, possibility that the electrical potential difference and current which are not meant from amplifier 52 as a result will be outputted unlike that by which the electric load conditions connected are meant arises. For this reason, the matching circuit 53, amplifier 52, and an ultrasonic vibrator 31 will be in an overload condition, and will affect a property and a life.

[0076] As a means for solving this, the following three kinds of cases are described in the gestalt of operation of this invention, for example.

[0077] There is an input-control method which controls the input wave to amplifier 52 by controlling the wave amplitude outputted from the wave generation section 51 as first solution means. The system control section 22 controls the output wave amplitude of the wave generation section 51 according to a frequency beforehand so that the current which neither the electrical potential difference which a design does not mean as shown in drawing 4 b, nor a design means is not outputted. The wave outputted from amplifier 52 in advance as the control approach of this wave generation section 51 based on the frequency characteristics of the impedance-characteristic information 42, the phase characteristic information 43, and the matching circuit 53 is calculated, and the output of the wave generation section 51 is controlled so that the electrical potential difference or current which are not meant are not impressed to an ultrasonic vibrator 31.

[0078] Or it is also possible to fix the wave amplitude outputted from the wave generation section, to expect by count that the electrical potential difference from which it separated from the predetermined design value, and a current are outputted, and to control the amplification factor of amplifier corresponding to the frequency to which the electrical potential difference from which it separated from the predetermined design value concerned, and the current will be outputted.

[0079] Or the amplifier amplification factor pattern according to individual corresponding to a frequency is made to memorize beforehand based on each ultrasonic vibrator, and the method of directing the amplification factor pattern in amplifier 52 is also considered.

[0080] moreover -- or the storage section 34 of the ultrasonic applicator 11 is made to memorize beforehand the output wave pattern according to individual based on each ultrasonic vibrator 31, and how to direct the output wave pattern in the wave generation section 51 can be considered.

[0081] There is the approach of adding a feedback circuit to amplifier 52 and controlling the amplification factor of amplifier 52 as second solution means. From the wave generation section 51, the wave of the fixed amplitude is outputted and the electrical potential difference and current which are impressed to an ultrasonic vibrator 31 by the output monitor 54 are observed.

[0082] And the amplification factor of amplifier 52 is controlled so that the value observed with the output monitor 54 does not exceed the reference value set up in advance. Moreover, the output wave amplitude of the wave generation section 51 may be controlled.

[0083] As third solution means, the equalizer circuit which is not illustrated between the wave generating section 51 and amplifier 52 is added, and there is the approach of controlling the output from amplifier 52 by controlling the input wave to amplifier 52.

[0084] The equalizer circuit which is not illustrated is a circuit which controls the attenuation factor of an output according to the inputted wave-like frequency, and sets up greatly the attenuation factor in the frequency band where generating of the current which neither the electrical potential difference which a design does not mean beforehand based on the frequency characteristics of the impedance-characteristic information 42, the phase characteristic information 43, and the matching circuit 63, nor a design means is predicted. Thereby, the input amplitude to amplifier 52 is restricted, and it controls so that the current which neither the electrical potential difference which a design does not mean from amplifier 52, nor a design means is not outputted.

[0085] After the conditions of the output wave generation section 51, amplifier 52, and the matching circuit 53 are set up as mentioned above, the optimal ultrasonic irradiation time determined according to conditions, such as the heat



denaturation map information 46 and treatment planning, is directed to the drive wave feed zone 13 from the system control section 22. The drive wave feed zone 13 supplies power to an ultrasonic vibrator 13 so that the supersonic wave of the optimal conditions may be outputted in the optimal time amount to a therapy.

[0086] An ultrasonic vibrator 31 is driven with the power supplied from the drive wave feed zone 13, and irradiates a supersonic wave to the part for a therapy. When the therapy range reaches far and wide, the therapy with which the migration of the ultrasonic applicator 11 and the exposure of a supersonic wave by the position control section 14 were combined is performed. However, the position control section 14 is not used, not being chosen in the case of the ultrasonic applicator 11 of a configuration which the equipment users in the case of using the applicator 11 for into the trap etc. hold by hand, and operate.

[0087] According to treatment planning, the exposure of a supersonic wave is performed as mentioned above, and a therapy is completed. The system control section 22 writes the information about the therapy of the diagnostic information after the diagnostic result before a therapy, treatment planning, and a therapy etc. in the therapy information storage section 21 after therapy termination.

[0088] Moreover, use hysteresis of an ultrasonic vibrator 31 is updated to the storage section 34 of the ultrasonic applicator 11 using the write-in section 20. Furthermore, when continuing a therapy, if needed, it can exchange for the ultrasonic applicator 11 of other classes, and a new therapy can be carried out.

[0089] With the gestalt of operation concerning the above this invention, all the individual information on the ultrasonic applicator 11 stated the configuration at the time of the storage section 34 in the ultrasonic applicator 11 memorizing to the example. However, as other approaches, only ID information coded [ serial number / the class of ultrasonic applicator 11 ] is given to the storage section 34, and the same effectiveness is acquired also by the approach of making the therapy information storage section 21 of the body of ultrasonic therapy equipment memorizing beforehand the individual information on the ultrasonic applicator 11 corresponding to the ID information.

[0090] In this case, after the system control section 22 incorporates ID information on the ultrasonic applicator 11 using the read-out section 19, it reads the individual information on the ultrasonic applicator 11 corresponding to that ID information from the therapy information storage section 21 of the body of ultrasonic therapy equipment, and performs various setup for a therapy. The vibrator individual information on the therapy information storage section 21 has the configuration which can perform modification and an addition to timely.

[0091] Here, since ID information on the ultrasonic applicator 11 is recorded, as an implementation means of the storage section 34, semiconductor memory, such as ROM and RAM, magnetic storage, optical storage, a bar code, etc. are applicable. Moreover, the approach of making the impedance information itself ID information and the approach of expressing binary code using the switch using an electrical circuit as shows drawing 5 can also be used by measuring the impedance characteristic and phase characteristic of an ultrasonic vibrator 31 using the output monitor 54.

[0092] When these approaches are used, the read-out section 19 uses the thing corresponding to each method. Moreover, write-in information, such as use hysteresis, is memorized with the individual information corresponding to ID information in the therapy information storage section 21 of the body of ultrasonic therapy equipment. Furthermore, how to divide and record the individual information on the ultrasonic applicator 11 on the storage section 34 of the ultrasonic applicator 11 and the therapy information storage section 21 of the body of ultrasonic therapy equipment is also considered.

[0093] In addition, the gestalt of the operation explained above was indicated in order to make an understanding of this invention easy, and it was not indicated in order to limit this invention. Therefore, each element indicated by the gestalt of the above-mentioned operation is the meaning also containing all the design changes belonging to the technical range of this invention, or equal objects.

[0094] For example With the gestalt of the above-mentioned implementation, the individual information on the ultrasonic applicator 11 The field information 45 which can be heated, such as a class / purpose-of-use information 44 the fundamental-frequency information 41 to constitute, the impedance-characteristic information 42 and the phase characteristic information 43, for [ for the outside of the body ] /into the trap, etc., and the focal depth of an ultrasonic vibrator 31, the heat denaturation map information 46, the size information 47 on an ultrasonic applicator, Although a series of examples in the case of treating using the information on the water circuit flow rate information 48, the ultrasonic probe information 49, and use hysteresis information 50 grade were shown, each information which constitutes such individual information can also be used in independent or two or more kinds of combination.

[0095]

[Effect of the Invention] As stated above, according to the ultrasonic therapy equipment by this invention, the same or when using two or more two or more kinds of ultrasonic applicators, by the serial No according to individual, there is [ easy and ] no mistake, a setup of drive conditions can be ensured, and discernment management of the information.

required for hysteresis management can be carried out.

[0096] Furthermore, based on the information according to each, the optimal propagation medium for each ultrasonic applicator is controllable.

[0097] furthermore -- setting up the drive conditions of a mistake, in case two or more ultrasonic applicators are exchanged \*\*\*\* -- or even if it should be alike and unexpected fault arises to an ultrasonic generation source, malfunction can be prevented under supervising an electrical potential difference and a current.

[0098] Furthermore, even if there is unexpected fault produced to the ultrasonic generation source, it can prevent that the supersonic wave which can perform suitable maintenance control since detection by the self-test can be performed beforehand, and is not meant is irradiated.

[0099] Moreover, the ultrasonic therapy equipment which brings about the optimal curative effect by the minimum invasion can be offered.

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[Translation done.]

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TECHNICAL FIELD

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[Field of the Invention] This invention relates to the ultrasonic therapy equipment which irradiates a supersonic wave and treats the part for a therapy.

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[Translation done.]



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PRIOR ART

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[Description of the Prior Art] There are a lithotripter which irradiates a powerful supersonic wave (impulse wave) from the outside of the body, and crushes a calculus to ultrasonic therapy equipment, an ultrasonic warm temperature therapeutic device (hyperthermia equipment) which only a cancer cell is annihilated using the difference in the heat sensitivity of neoplasm tissue and normal tissue, and treats a neoplasm, an ultrasonic cautery therapeutic device which treats by converging a supersonic wave on the part for a therapy, irradiating, and carrying out the heating necrosis of cancer, a neoplasm, etc. in the living body.

[0003] In case it treats using these equipments, according to the difference in the therapy approach, a therapy part, etc., it will be necessary to use two or more kinds of ultrasonic applicators properly.

[0004] Especially in the ultrasonic cautery therapeutic device, when treating the affected part inside an organ under the case where the direct affected part is treated from the outside of the body, or an incision in the abdomen, or when treating combining the laparoscope, an endoscope, etc., the therapy approach that plurality differs is examined. Two or more kinds of ultrasonic applicators furthermore set by the purpose according to the difference in the magnitude of a therapy object domain or a configuration are needed.

[0005] modification of the various set points which contain reinforcement, irradiation time, a frequency of a supersonic wave, etc. for every ultrasonic applicator when using two or more kinds of such ultrasonic applicators -- it is necessary to carry out -- moreover -- or it is generated also when you need modification of treatment planning which includes examination of the exposure approach of a supersonic wave according to each ultrasonic applicator.

[0006] moreover, the field which enables the therapy of the ultrasonic applicator concerned chosen to the equipment user -- or it is necessary to change the conditioning of the display means for telling the therapy condition by ultrasonic irradiation, and a voice generating means

[0007] In order to change these various setup accompanying modification of an ultrasonic applicator, it is necessary to carry out exchange of the circuit apparatus concerning the drive wave feed zone for generating the input of modification information, the change of the various switches accompanying it, and the wave that drives an ultrasonic sound source etc.

[0008] As a conventional technique, according to JP,7-289577,A, in case ultrasonic vibrators are exchanged, the configuration that the main frame sets up the frequency according to the resistance concerned corresponding to the detected resistance is indicated by detecting the resistance of the resistance with which the ultrasonic vibrator is equipped.

[0009] However, in such a conventional technique, it is because just the drive frequency of vibrator is not enough as the information which the body of ultrasonic therapy equipment needs in order to prepare two or more kinds of ultrasonic applicators to the body of one ultrasonic therapy equipment, to drive these ultrasonic applicators of a variety of appropriately when exchanging and using according to various therapy conditions, and to acquire sufficient curative effect.

[0010] In the former, in using ultrasonic therapy equipment, the reinforcement of a supersonic wave, irradiation time, the target field which can be treated, etc. are indispensable, and, naturally those conditions change with the classes and applications of an ultrasonic applicator.

[0011] For this reason, when exchanging a variety of ultrasonic applicators and applying to a therapy, corresponding to each ultrasonic applicator, various setup by the side of the body of ultrasonic therapy equipment needed to be changed manually.

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[Translation done.]

JAPANESE

[JP,2000-175926,A]

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CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION  
TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

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TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] However, modification of these conventional various setup was a very complicated activity covering two or more items. Moreover, if a setting change is made human, the error of a setup may occur, and when the error of such a setup occurs [ 10,000 ] also in 1, faults, such as actuation on the conditions on which it does not have the intention of equipment, may arise.

[0013] furthermore, the effect on the organization by the exposure of the ultrasonic output which deviated from the predetermined value which the right therapy which met treatment planning by the error of a setup was not performed, or the design meant -- and the condition which is not desirable for the subject may generate the effect on a blood vessel which is not meant.

[0014] Thus, exact and positive modification of various setup at the time of the effect by the error of a setup in ultrasonic therapy equipment exchanging the ultrasonic applicator with which it is large with an applicator and some kinds differ to the error of a setup in an ultrasonic diagnostic imaging equipment is very important.

[0015] In this invention, it is made to make a change of various setup of the body of ultrasonic therapy equipment accompanying exchange of two or more kinds of ultrasonic applicators according to the therapy purpose automatically, and the human error of compaction of the working hours required in order to set up, and a setup is prevented beforehand, and it aims at offering the ultrasonic therapy equipment which brings about the optimal curative effect by the minimum invasion.

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MEANS

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[Means for Solving the Problem] In the ultrasonic therapy equipment which according to this invention according to claim 1 irradiates a supersonic wave to the predetermined part for a therapy, and acquires a curative effect in order to attain the above-mentioned purpose The ultrasonic generation source which generates said supersonic wave, and the driving means which performs the drive of this ultrasonic generation source, the control means which performs motion control of this driving means, a storage means to hold the individual information for performing said motion control of said ultrasonic generation source, and the read-out means for reading said individual information from said storage means -- since -- let it be a solution means to be constituted with the ultrasonic therapy equipment by which it is characterized.

[0017] Moreover, according to this invention according to claim 2, let it be a solution means to have a write-in means for writing said individual information in said storage means with the ultrasonic therapy equipment according to claim 1 by which it is characterized.

[0018] Moreover, according to this invention according to claim 3, it has the ultrasonic applicator which has the structure which can be freely detached and attached from the body of said ultrasonic therapy equipment, and irradiates a supersonic wave to said part for a therapy, and said storage means to hold said individual information, and said ultrasonic generation source make it a solution means to have the configuration included in said ultrasonic applicator with the ultrasonic therapy equipment according to claim 1 or 2 by which it is characterized.

[0019] Moreover, according to this invention according to claim 4, let it be a solution means to have said storage means by which replaced with said individual information and the identification code corresponding to this individual information was held with the ultrasonic therapy equipment according to claim 3 by which it is characterized.

[0020] Moreover, according to this invention according to claim 5, let it be a solution means to have said ultrasonic generation source which has an image diagnostic-ultrasound probe and said individual information containing setups required for actuation of this image diagnostic-ultrasound probe with the ultrasonic therapy equipment of a publication at either of claims 1-4 by which it is characterized.

[0021] Moreover, according to this invention according to claim 6, the ultrasonic propagation medium of said ultrasonic generation source makes it a solution means to have the propagation medium control means which controls at least one of the amount of said propagation medium in the enclosure means enclosed with the interior, impregnation, discharge, or temperature with the ultrasonic therapy equipment of a publication at either of claims 1-5 by which it is characterized.

[0022] According to this invention according to claim 7, said individual information Moreover, said ultrasonic generation source, Predetermined reinforcement and time amount of a supersonic wave which irradiate drive frequency, an impedance characteristic or/and a phase characteristic, and an object part, The thermal denaturation area size, the class, or/and the purpose of using the object part in ultrasonic irradiation, Among the amount of the field which can be treated, magnitude or/and a configuration, use hysteresis, and said propagation medium, impregnation, discharge, or temperature, at least one setups required for a drive, and \*\* -- let it be a solution means to express at least one or more inside with the ultrasonic therapy equipment of a publication at either of claims 1-6 by which it is characterized.

[0023] Moreover, according to this invention according to claim 8, said individual information makes it a solution means to express the control condition for preventing generating of the different electrical potential difference and different current from a predetermined value with the ultrasonic therapy equipment of a publication at either of claims 1-7 by which it is characterized.

[0024] Moreover, according to this invention according to claim 9, let it be a solution means to have a received wave analysis means to analyze the reflected wave which said ultrasonic generation source sent the supersonic wave with the predetermined output, and this ultrasonic generation source received after predetermined time, and a self-test means by

which the analysis result output from said received wave analysis means performs the self-test of said ultrasonic generation source with the ultrasonic therapy equipment of a publication at either of claims 1-8 by which it is characterized.

[0025] moreover, an adjustment means by which said ultrasonic generation source performs load adjustment with at least one or more ultrasonic generating components, and said ultrasonic generating component and said driving means according to this invention according to claim 10 -- since -- let it be a solution means to be constituted with the ultrasonic therapy equipment of a publication at either of claims 1-9 by which it is characterized.

[0026] Moreover, according to this invention according to claim 11, it sets to the ultrasonic therapy equipment which irradiates the supersonic wave emitted from the ultrasonic generation source driven by the driving means to the predetermined part for a therapy, and acquires a curative effect. Compare the drive wave pattern beforehand remembered to be the drive wave impressed to said ultrasonic generation source by said driving means by this body of ultrasonic therapy equipment, and it sets un-agreeing [ agreement or ]. Let it be a solution means to have the control means which stops the output of this drive wave with the ultrasonic therapy equipment by which it is characterized.

[0027] Moreover, according to this invention according to claim 12, it sets to the ultrasonic therapy equipment which irradiates the supersonic wave emitted from the ultrasonic generation source driven by the driving means to the predetermined part for a therapy, and acquires a curative effect. Compare the drive wave impressed to said ultrasonic generation source by said driving means with the prediction drive wave computed based on the electrical characteristics of this ultrasonic generation source, and it sets un-agreeing [ agreement or ]. Let it be a solution means to have the control means which stops the output of this drive wave with the ultrasonic therapy equipment by which it is characterized.

[0028] Moreover, according to this invention according to claim 13, it sets to the ultrasonic therapy equipment which irradiates the supersonic wave emitted from the ultrasonic generation source driven by the driving means to the predetermined part for a therapy, and acquires a curative effect. The drive wave outputted by said driving means makes it a solution means to have an impression band control means by the configuration impressed to said ultrasonic generation source via the band-pass filter which passes only a predetermined frequency band with the ultrasonic therapy equipment by which it is characterized.

[0029] Moreover, according to this invention according to claim 14, let it be a solution means for the supersonic wave irradiated from said ultrasonic generation source to converge on a predetermined location with a focusing means with any one or the ultrasonic therapy equipment of any one publication in claims 5-13 of the claims 1-3 by which it is characterized.

[0030] If it does in this way, when using two or more ultrasonic applicators of the same class, based on individual information, there is [ easy and ] no mistake, a setup of drive conditions can be ensured, and discernment management of the information required for hysteresis management can be carried out.

[0031] Furthermore, based on the information according to each, the optimal propagation medium for each ultrasonic applicator is controllable.

[0032] furthermore -- setting up the drive conditions of a mistake, in case two or more ultrasonic applicators are exchanged \*\*\*\* -- or even if it should be alike and unexpected fault arises to an ultrasonic generation source, malfunction can be prevented under supervising an electrical potential difference and a current.

[0033] Furthermore, even if there is unexpected fault produced to the ultrasonic generation source, it can prevent that the supersonic wave which can perform suitable maintenance control since detection by the self-test can be performed beforehand, and is not meant is irradiated.

[0034]

[Embodiment of the Invention] Hereafter, the operation gestalt of this invention is explained based on a drawing.

[0035] Being shown in drawing 1 expresses typically the configuration of the ultrasonic therapy equipment concerning this invention.

[0036] The ultrasonic applicator 11 with which the ultrasonic therapy equipment concerning this invention irradiates a supersonic wave, The water circuit 12 which makes the ultrasonic applicator 11 circulate through degassed water 35, and the drive wave feed zone 13 which supplies energy to an ultrasonic generation source, The position control section 14 for moving an ultrasonic vibrator 31, and the control unit 16 which performs input of a patient's data etc., and actuation of equipment, The image display section 16 and the voice generating section 17 which tell an equipment user about therapy information and a condition, The ultrasonic diagnostic imaging section 18 for obtaining the image information of a therapy field, and the read-out section 19 for taking out the individual information on the ultrasonic applicator 11 to the ultrasonic applicator 11, It consists of the write-in section 20 for recording information, such as use hysteresis of the ultrasonic applicator 11, the therapy information storage section 21 which memorizes various therapy

information, and the system control section 22 which generalizes and controls the whole ultrasonic therapy equipment. [0037] Being shown in drawing 2 a expresses typically the configuration of the ultrasonic applicator 11 concerning this invention.

[0038] the coupling film 33 for the ultrasonic applicator 11 to spread the ultrasonic vibrator 31 which is an ultrasonic generation source, the ultrasonic probe 32 for ultrasonic image 3 \*\*, and the supersonic wave irradiated from the ultrasonic vibrator 31 to a body tissue, and the storage section 34 which memorizes the individual information on an ultrasonic applicator -- since -- it becomes. Moreover, it is filled with ultrasonic propagation media, such as degassed water 36, between an ultrasonic vibrator 31 and the coupling film 33.

[0039] Being shown in drawing 2 b expresses the outline of the component of the storage section 34 concerning this invention.

[0040] As shown in drawing, the individual information on the ultrasonic applicator 11 is memorized by the storage section 34.

[0041] The contents of such individual information The field information 45 which can be heated, the therapy depth and injection power, such as a class / purpose-of-use information 44 the fundamental-frequency information 41, the impedance-characteristic information 42 depending on the frequency of an ultrasonic vibrator 31 and the phase characteristic information 43, for [ for the outside of the body ] /into the trap, etc., and the focal depth of an ultrasonic vibrator 31 And the relation between irradiation time and the thermal denaturation area size of an affected part organization The ultrasonic applicator which made the main things the ultrasonic probe information 49, such as a class of the shown heat denaturation map information 46, the size information 47 on the ultrasonic applicator 11, the water circuit flow rate information 48, and image diagnostic-ultrasound probe, and a frequency, use hysteresis information 50, etc. It consists of required information for using it.

[0042] The ultrasonic vibrator 31 has fundamental frequency for every class, and when an ultrasonic vibrator 31 is driven in the fundamental frequency, it can transform electrical energy into ultrasonic energy most efficiently. Therefore, the fundamental-frequency information 41 at the time of driving an ultrasonic vibrator 31 turns into important information, and the drive wave feed zone 13 determines the drive frequency of the ultrasonic vibrator 31 concerned based on this information.

[0043] In case the frequency modulation driving method is used for the impedance-characteristic information 42 and a phase characteristic 43, they become important. When an ultrasonic vibrator 31 is driven on a frequency which is different in fundamental frequency 41, matching of the ultrasonic vibrator 31 including the matching circuit 53 at the time of originating in the impedance characteristic and phase characteristic of an ultrasonic vibrator 31, and seeing from an amplifier 52 side shifts from an optimum value. For this reason, the different electrical potential difference and different current from a predetermined design value depending on drive frequency may be supplied to a trembler 31, and electrical load which is different from a predetermined design value in amplifier 52, or the matching circuit 53 and an ultrasonic vibrator 31 may be impressed.

[0044] Then, in the ultrasonic therapy equipment concerning this invention, using the impedance-characteristic information 42 and the phase characteristic information 43, before a supersonic wave is irradiated, a different output from a predetermined design value controls the drive wave feed zone 13 using the suitable output set point which computed the suitable output value not becoming and was computed by beforehand [ the ].

[0045] By showing the class of ultrasonic applicator 11 which the equipment user chose, a class / purpose-of-use information 44 is used in order that an equipment user may check that the suitable applicator 11 corresponding to the therapy made into the purpose is chosen, and it is used for operation and un-working, a setup of the operation range, etc. [ of the position control section 14 ] For example, when the ultrasonic applicator 11 is an object for into the trap, the position control section 14 does not work but can consider the case where it is used when an equipment user holds the ultrasonic applicator 11 by hand.

[0046] The field information 45 which can be heated shows the focal depth of the selected ultrasonic applicator 11, and to the ultrasonic image used for the diagnosis before the therapy, by displaying in piles the field which can be treated, it is used in order to tell an equipment user about the part which can be treated.

[0047] Moreover, the heat denaturation map information 46 is the information which showed the relation of the reinforcement of the supersonic wave at the time of treating using the selected ultrasonic applicator 11, and the thermal denaturation area size of irradiation time and an affected part organization, and in order to perform an effective therapy, it is important information.

[0048] When irradiation time is short, in order that the reinforcement of a supersonic wave is not smaller than a proper value, or thermal denaturation of the purpose part may not be carried out completely and a cancer cell etc. may not carry out a thermal denaturation necrosis, a curative effect is not fully acquired.

[0049] Moreover, when irradiation time is long, more than ultrasonic reinforcement is larger than a proper value, or the affected part carries out thermal denaturation, for example, the effect of [ to the organization of the purpose part ] which is not meant may arise.

[0050] For this reason, the heat denaturation map information 46 turns into important information for performing the most effective therapy for invasion at its minimum. The depth of a therapy part and the parameter of a location are also woven in, and this heat denaturation map information 46 makes detailed conditioning possible.

[0051] Moreover, the size information 47 on the ultrasonic applicator 11 is needed when controlling a successive range etc., in case the position control section moves the ultrasonic applicator 11, and the water circuit flow rate information 48 turns into important information, when controlling the water circuit 12.

[0052] In case the ultrasonic applicator 11 especially small [ for into the trap etc. ] is used, it originates in the absolute volume and there is an inclination for generation of heat from an ultrasonic vibrator 31 to become large in comparison. On the other hand, by performing suitable control of the water circuit 12 based on the water circuit flow rate information 48, generation of heat of the ultrasonic applicator 11 which is not meant can be prevented effectively. It can prevent that the predetermined ultrasonic output by furthermore the impedance characteristic and phase characteristic of an ultrasonic vibrator 31 changing with generation of heat which an ultrasonic vibrator 31 does not mean is no longer obtained.

[0053] Moreover, when the material which has elasticity in the coupling film 33 shown in drawing 2 a is used, telescopic motion of the coupling film 33 can be produced by carrying out impregnation of degassed water and control of a discharge. Since the thickness (depth of water of vertical degassed water 35) of the ultrasonic propagation medium enclosure section changes by this telescopic motion, the focal location of the supersonic wave irradiated according to the purpose of a therapy etc. can be adjusted free.

[0054] The ultrasonic probe information 49 sets up the various conditions of the ultrasonic diagnostic imaging section 18, and it is used in order to obtain the tomogram for ultrasonic diagnostic imaging. The use hysteresis information 50 turns into information required in order to be used for the purpose of engine-performance maintenance of telling an equipment user about the maintenance stage of an ultrasonic vibrator 31 and to ensure the stable therapy by recording the use hysteresis of the ultrasonic applicator 11.

[0055] As an implementation means of the storage section 34, use of semiconductor memory, such as RAM and ROM, magnetic storage, etc. can be considered, for example. The degassed water 35 supplied from the water circuit 12 between an ultrasonic vibrator 31 and the coupling film 33 is filled. The ultrasonic applicator 11 can be simply attached and removed on a body.

[0056] The outline configuration of the drive wave feed zone 13 which starts this invention at drawing 3 is shown.

[0057] The drive wave feed zone 13 concerning the gestalt of operation of this invention The wave generation section 51 which generates the drive wave for driving an ultrasonic vibrator 31, The amplifier 52 for amplifying the wave outputted from the wave generation section 51, the matching circuit 53 for supplying power to an ultrasonic vibrator 31 efficiently, and the output monitor 54 which checks the output state of amplifier 52 -- since -- it has the configuration which supplies a drive wave to an ultrasonic vibrator 31 with the directions from the system control section 22.

[0058] If put into the power source of ultrasonic therapy equipment by the equipment user, the system control section 22 will perform the connection confirm of the ultrasonic applicator 11. When a defect has the ultrasonic applicator 11 in un-connecting or connection, the system control section 22 gives an equipment user warning through the image display section 16 and the voice generating section 17.

[0059] When the ultrasonic applicator 11 is connected normally, the system control section 22 reads the individual information on the ultrasonic applicator 11 from the storage section 34 of the ultrasonic applicator 11 using the read-out section 19.

[0060] The system control section 22 tells an equipment user about therapy adaptation information, such as a class of ultrasonic applicator 11, and external use / use into the trap, through the image display section 16 or the voice generating section 17 based on the read class / purpose-of-use information 44, and tells an equipment user about therapy information corresponding to the therapy mode, such as a field which can be treated, through the image display section 16 further.

[0061] Thereby, an equipment user can check whether the suitable ultrasonic applicator 11 for the purpose of use is connected, and can perform a suitable therapy.

[0062] In this case, hysteresis, such as an old time of vibrator, is displayed on the image display section 16, and an equipment user is told about an exchange stage, an inspection stage, etc. which the design based on aging of the ultrasonic applicator 11 means. For this reason, an equipment user can always check the use hysteresis of the ultrasonic applicator 11, and the suitable maintenance of him is attained. Moreover, when it passes over an exchange stage, the



insurance device of controlling impossible [ a therapy ] using the applicator can also be added.

[0063] Moreover, based on the therapy mode information 44 and the ultrasonic applicator size information 47, use / intact selection, movable range, etc. of the position control section 14 are set up, and an equipment user is told through the image display section 16.

[0064] Next, the system control section 22 controls the water circuit 12 based on the water circuit flow rate information 48 on the ultrasonic applicator 11, and sets up the ultrasonic diagnostic imaging section 18 based on the ultrasonic probe information 47. By controlling the suitable water circuit 12 corresponding to the ultrasonic applicator 11, generation of heat which the ultrasonic applicator 11 at the time of a therapy does not mean can be prevented.

[0065] Moreover, since change of the impedance characteristic of the ultrasonic vibrator 31 by generation of heat and a phase characteristic can be pressed down by controlling the above-mentioned water circuit 12, it can treat by irradiating suitable and the stable supersonic wave of an output.

[0066] In addition, when degassed water 35 is filled by the ultrasonic applicator 11, the ultrasonic probe 32 with which the ultrasonic applicator 11 concerned was equipped can be used now, and it becomes possible to perform the diagnostic imaging by the ultrasonic tomogram required in order to form treatment planning.

[0067] If control of the water circuit 12 is performed and it is [ using the ultrasonic tomogram by the ultrasonic probe 32 ] ready for diagnostic imaging, the system control section 22 will tell an equipment user about diagnostic imaging having become possible through the image display section 16 or the voice generating section 17. At this time, an equipment user performs the diagnostic imaging of the part for a therapy, and a control unit 15 is operated based on the image diagnostic information obtained by this. Various setup of ultrasonic therapy equipment based on treatment planning which starts the part for a therapy by this actuation is inputted.

[0068] Before starting an actual therapy here, the system control section 22 performs a prior self-test, in order to check the function of an ultrasonic vibrator 31. With self-test directions of the ultrasonic vibrator 31 of the system control section 22, the drive wave feed zone 13 impresses the wave of the very weak output of extent which does not affect a living body to an ultrasonic vibrator 31. Next, the reflective power of the reflected wave which changed vibrator 31 to the receive state and the vibrator 31 concerned received is measured with the output monitor 54.

[0069] The comparison with this measured reflective power and the reflective power which was computed from the impedance characteristic 42 and the phase characteristic 43 and which is expected is performed. When the difference of the actual measurement of reflective power and a calculation value compares whether it is in criteria within the limits, it can know whether the property of an ultrasonic vibrator 31 is normal. If the property of an ultrasonic vibrator 31 is normal, the system control section 22 will direct continuation of a therapy as it is.

[0070] If the property of vibrator 31 is unusual, the system control section 22 will tell an equipment user about the abnormalities of an ultrasonic vibrator 31 through the image display section 16 and the voice generating section 17, and will suspend a therapy immediately. Not only before initiation of a therapy but after degassed water is filled by the ultrasonic applicator 11, the self-test of an ultrasonic vibrator 31 can be performed in every phase, and may carry out multiple-times operation in each phase of a therapy.

[0071] If treatment planning is inputted, the system control section 22 will determine ultrasonic irradiation conditions, such as irradiation time of a supersonic wave, injection power, and the exposure approach, based on the heat denaturation map information 46. The heat denaturation map information 46 shows the relation between the irradiation time of a supersonic wave, injection power, and the thermal denaturation area size of the affected part, and changes with ultrasonic applicators 11 to be used.

[0072] moreover, the distance from the body surface of the part for a therapy -- or the optimal conditioning is minutely made by the location of the distance from the front face of the part for a therapy, and the part for a therapy. Based on the determined ultrasonic irradiation conditions, the system control section 22 gives directions to the drive wave feed zone 13 and the position control section 14, and a therapy is started.

[0073] The system control section 22 directs an output wave amplitude that the injection power which directed the drive frequency based on the fundamental-frequency information 41 in the wave generation section 51, and was specified based on the impedance-characteristic information 42 and the phase characteristic information 43 by the above-mentioned treatment planning is obtained in the wave generation section 51. Furthermore, it sets up so that the matching circuit 53 may be in the optimal condition based on the fundamental-frequency information 41, the impedance-characteristic information 42, and the phase characteristic information 43.

[0074] The schematic diagram shows the relation between the output wave of the wave generation section 51 concerning the gestalt of operation of this invention, and the output wave of amplifier 52 to drawing 4 a and drawing 4 b.

[0075] In the drive conditions which use a frequency modulation method for an ultrasonic output especially, since it



becomes impossible to take impedance matching of the matching circuit 53 and an ultrasonic vibrator 31 except fundamental frequency as shown in drawing 4 a, possibility that the electrical potential difference and current which are not meant from amplifier 52 as a result will be outputted unlike that by which the electric load conditions connected are meant arises. For this reason, the matching circuit 53, amplifier 52, and an ultrasonic vibrator 31 will be in an overload condition, and will affect a property and a life.

[0076] As a means for solving this, the following three kinds of cases are described in the gestalt of operation of this invention, for example.

[0077] There is an input-control method which controls the input wave to amplifier 52 by controlling the wave amplitude outputted from the wave generation section 51 as first solution means. The system control section 22 controls the output wave amplitude of the wave generation section 51 according to a frequency beforehand so that the current which neither the electrical potential difference which a design does not mean as shown in drawing 4 b, nor a design means is not outputted. The wave outputted from amplifier 52 in advance as the control approach of this wave generation section 51 based on the frequency characteristics of the impedance-characteristic information 42, the phase characteristic information 43, and the matching circuit 53 is calculated, and the output of the wave generation section 51 is controlled so that the electrical potential difference or current which are not meant are not impressed to an ultrasonic vibrator 31.

[0078] Or it is also possible to fix the wave amplitude outputted from the wave generation section, to expect by count that the electrical potential difference from which it separated from the predetermined design value, and a current are outputted, and to control the amplification factor of amplifier corresponding to the frequency to which the electrical potential difference from which it separated from the predetermined design value concerned, and the current will be outputted.

[0079] Or the amplifier amplification factor pattern according to individual corresponding to a frequency is made to memorize beforehand based on each ultrasonic vibrator, and the method of directing the amplification factor pattern in amplifier 52 is also considered.

[0080] moreover -- or the storage section 34 of the ultrasonic applicator 11 is made to memorize beforehand the output wave pattern according to individual based on each ultrasonic vibrator 31, and how to direct the output wave pattern in the wave generation section 51 can be considered.

[0081] There is the approach of adding a feedback circuit to amplifier 52 and controlling the amplification factor of amplifier 52 as second solution means. From the wave generation section 51, the wave of the fixed amplitude is outputted and the electrical potential difference and current which are impressed to an ultrasonic vibrator 31 by the output monitor 54 are observed.

[0082] And the amplification factor of amplifier 52 is controlled so that the value observed with the output monitor 54 does not exceed the reference value set up in advance. Moreover, the output wave amplitude of the wave generation section 51 may be controlled.

[0083] As third solution means, the equalizer circuit which is not illustrated between the wave generating section 51 and amplifier 52 is added, and there is the approach of controlling the output from amplifier 52 by controlling the input wave to amplifier 52.

[0084] The equalizer circuit which is not illustrated is a circuit which controls the attenuation factor of an output according to the inputted wave-like frequency, and sets up greatly the attenuation factor in the frequency band where generating of the current which neither the electrical potential difference which a design does not mean beforehand based on the frequency characteristics of the impedance-characteristic information 42, the phase characteristic information 43, and the matching circuit 63, nor a design means is predicted. Thereby, the input amplitude to amplifier 52 is restricted, and it controls so that the current which neither the electrical potential difference which a design does not mean from amplifier 52, nor a design means is not outputted.

[0085] After the conditions of the output wave generation section 51, amplifier 52, and the matching circuit 53 are set up as mentioned above, the optimal ultrasonic irradiation time determined according to conditions, such as the heat denaturation map information 46 and treatment planning, is directed to the drive wave feed zone 13 from the system control section 22. The drive wave feed zone 13 supplies power to an ultrasonic vibrator 13 so that the supersonic wave of the optimal conditions may be outputted in the optimal time amount to a therapy.

[0086] An ultrasonic vibrator 31 is driven with the power supplied from the drive wave feed zone 13, and irradiates a supersonic wave to the part for a therapy. When the therapy range reaches far and wide, the therapy with which the migration of the ultrasonic applicator 11 and the exposure of a supersonic wave by the position control section 14 were combined is performed. However, the position control section 14 is not used, not being chosen in the case of the ultrasonic applicator 11 of a configuration which the equipment users in the case of using the applicator 11 for into the

trap etc. hold by hand, and operate.

[0087] According to treatment planning, the exposure of a supersonic wave is performed as mentioned above, and a therapy is completed. The system control section 22 writes the information about the therapy of the diagnostic information after the diagnostic result before a therapy, treatment planning, and a therapy etc. in the therapy information storage section 21 after therapy termination.

[0088] Moreover, use hysteresis of an ultrasonic vibrator 31 is updated to the storage section 34 of the ultrasonic applicator 11 using the write-in section 20. Furthermore, when continuing a therapy, if needed, it can exchange for the ultrasonic applicator 11 of other classes, and a new therapy can be carried out.

[0089] With the gestalt of operation concerning the above this invention, all the individual information on the ultrasonic applicator 11 stated the configuration at the time of the storage section 34 in the ultrasonic applicator 11 memorizing to the example. However, as other approaches, only ID information coded [ serial number / the class of ultrasonic applicator 11 ] is given to the storage section 34, and the same effectiveness is acquired also by the approach of making the therapy information storage section 21 of the body of ultrasonic therapy equipment memorizing beforehand the individual information on the ultrasonic applicator 11 corresponding to the ID information.

[0090] In this case, after the system control section 22 incorporates ID information on the ultrasonic applicator 11 using the read-out section 19, it reads the individual information on the ultrasonic applicator 11 corresponding to that ID information from the therapy information storage section 21 of the body of ultrasonic therapy equipment, and performs various setup for a therapy. The vibrator individual information on the therapy information storage section 21 has the configuration which can perform modification and an addition to timely.

[0091] Here, since ID information on the ultrasonic applicator 11 is recorded, as an implementation means of the storage section 34, semiconductor memory, such as ROM and RAM, magnetic storage, optical storage, a bar code, etc. are applicable. Moreover, the approach of making the impedance information itself ID information and the approach of expressing binary code using the switch using an electrical circuit as shows drawing 5 can also be used by measuring the impedance characteristic and phase characteristic of an ultrasonic vibrator 31 using the output monitor 54.

[0092] When these approaches are used, the read-out section 19 uses the thing corresponding to each method. Moreover, write-in information, such as use hysteresis, is memorized with the individual information corresponding to ID information in the therapy information storage section 21 of the body of ultrasonic therapy equipment. Furthermore, how to divide and record the individual information on the ultrasonic applicator 11 on the storage section 34 of the ultrasonic applicator 11 and the therapy information storage section 21 of the body of ultrasonic therapy equipment is also considered.

[0093] In addition, the gestalt of the operation explained above was indicated in order to make an understanding of this invention easy, and it was not indicated in order to limit this invention. Therefore, each element indicated by the gestalt of the above-mentioned operation is the meaning also containing all the design changes belonging to the technical range of this invention, or equal objects.

[0094] For example With the gestalt of the above-mentioned implementation, the individual information on the ultrasonic applicator 11 The field information 45 which can be heated, such as a class / purpose-of-use information 44 the fundamental-frequency information 41 to constitute, the impedance-characteristic information 42 and the phase characteristic information 43, for [ for the outside of the body ] /into the trap, etc., and the focal depth of an ultrasonic vibrator 31, the heat denaturation map information 46, the size information 47 on an ultrasonic applicator, Although a series of examples in the case of treating using the information on the water circuit flow rate information 48, the ultrasonic probe information 49, and use hysteresis information 50 grade were shown, each information which constitutes such individual information can also be used in independent or two or more kinds of combination.

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[Translation done.]

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## DESCRIPTION OF DRAWINGS

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### [Brief Description of the Drawings]

[Drawing 1] It is the mimetic diagram showing the configuration of the ultrasonic therapy equipment concerning this invention.

[Drawing 2] (a) is the mimetic diagram showing the configuration of the ultrasonic applicator concerning this invention, and (b) is the schematic diagram showing the component of the storage section concerning this invention.

[Drawing 3] It is the schematic diagram showing the configuration of the drive wave feed zone concerning this invention.

[Drawing 4] (a) And it is the schematic diagram of the relation between the output wave of the wave generation section concerning the gestalt of operation of this invention, and the output wave of amplifier which is shown in (b).

[Drawing 5] It is a schematic diagram for explaining the configuration for recording ID information on the ultrasonic applicator of the gestalt of operation concerning this invention.

### [Description of Notations]

- 11 -- Ultrasonic applicator
- 12 -- Water circuit
- 13 -- Drive wave feed zone
- 14 -- Position control section
- 15 -- Control unit
- 16 -- Image display section
- 17 -- Voice generating section
- 18 -- Ultrasonic diagnosis section
- 19 -- Read-out section
- 20 -- The write-in section
- 21 -- Therapy information storage section
- 22 -- System control section
- 31 -- Ultrasonic vibrator
- 32 -- Ultrasonic probe
- 33 -- Coupling film
- 34 -- Storage section
- 41 -- Fundamental-frequency information
- 42 -- Impedance-characteristic information
- 43 -- Phase characteristic information
- 44 -- A class / purpose-of-use information
- 45 -- Field information which can be heated
- 45 -- Heat denaturation map information
- 47 -- Ultrasonic applicator size information
- 48 -- Water circuit flow rate information
- 49 -- Ultrasonic probe information
- 50 -- Use hysteresis information
- 51 -- Wave generation section
- 52 -- Amplifier
- 53 -- Matching circuit
- 54 -- Output-monitor

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[Translation done.]

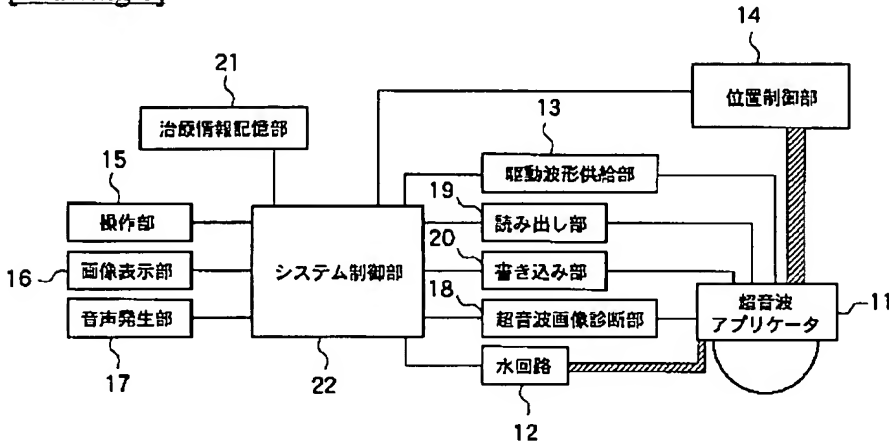
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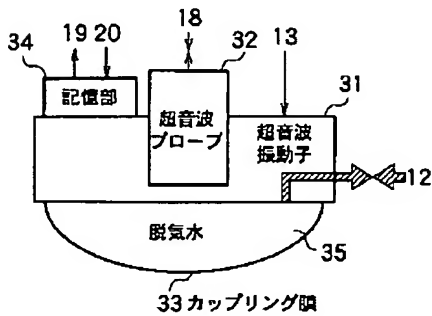
## DRAWINGS

[Drawing 1]

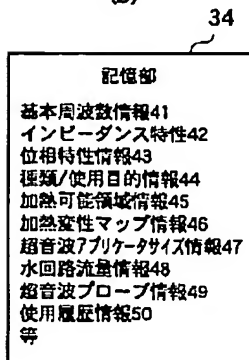


[Drawing 2]

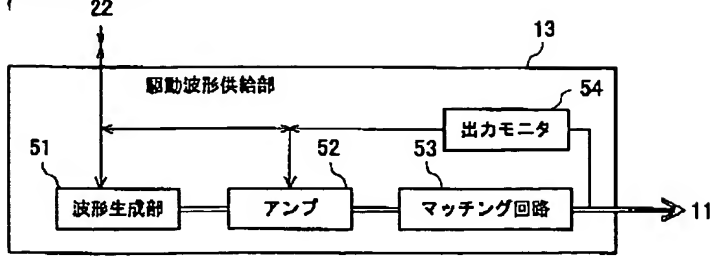
(a)



(b)

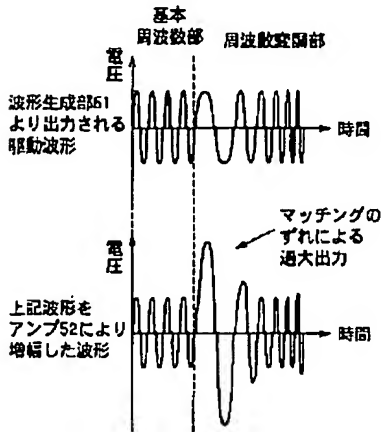


[Drawing 3]

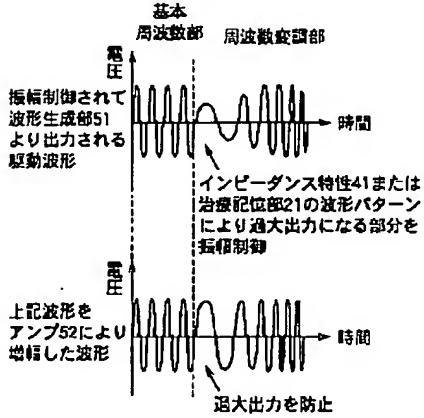


[Drawing 4]

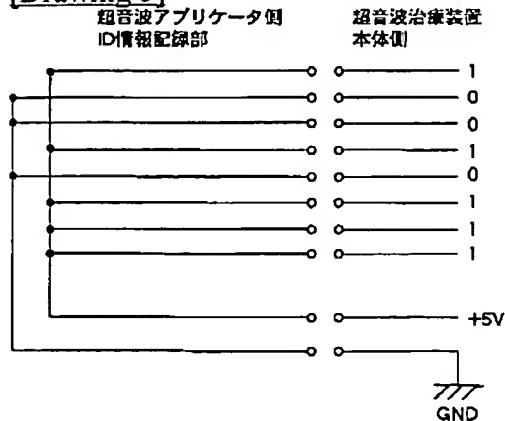
(a)



(b)



[Drawing 5]



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